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ABSTRACT

This unit of instruction deals with the examination of minerals in the earth's crust and their formation into rocks. No prerequisites are required for enrollment in the course. The booklet lists the relevant state-adopted texts and states the performance objectives for the unit. It provides an outline of the course content and suggests experiments, demonstrations, teacher directed activities, innovative activities, field trips, guest speakers, and topics for student projects discussion questions, and reports. Also listed are relevant films, slides, and filmstrips available from the Dade County Audiovisual Center. Reference books, models, and sources for supplies are recommended, and a master sheet is provided relating each suggested activity to the specific performance objectives. (JR)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

MINERALOGY

5343.02
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5312.27
5313.27

SCIENCE
(Experimental)

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

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(Experimental)

Written by Jeannette Gato
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida
1972

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MINERALOGY

COURSE DESCRIPTION

This course examines the minerals in the earth's crust and their formation into rocks.

ENROLLMENT GUIDELINES

None

STATE ADOPTED TEXTS

1. Brandwein, Paul F.; Beck, Alfred D.; Strahler, Violet R.; Brennan, Matthew J.; and Turner, Daniel S. The Earth: Its Changing Form. New York: Harcourt, Brace & World, Inc., 1970.

2. Brown, Martin F.; Kemper, Grace H.; and Lewis, John H. Earth Science. Atlanta: Silver Burdett Company, 1970.

3. Hibbs, Albert and Eiss, Albert. The Earth-Space Sciences. Atlanta: Laidlaw Brothers Publishers, 1971.

PERFORMANCE OBJECTIVES

1. The student will identify the conditions which are prerequisite for the formation of a mineral.

2. The student will differentiate among the common mineral families.

3. The student will analyze the various physical properties of minerals.

4. Given various common mineral samples, the student will identify them by analyzing their physical properties.

5. The student will distinguish between metallic and nonmetallic minerals including the identification of several common minerals in each class.

6. Given information about the formation of gemstones, the student will describe the qualities that determine the value of them.

7. The student will investigate the possible source of minerals in the sea.

8. Given igneous, sedimentary, and metamorphic rocks, the student will investigate the manner in which each is formed.

9. Given a variety of common rock samples, the student will identify and place them in their proper classes and subclasses.

10. The student will propose reasons why rocks and minerals are important in his life.

11. The student will investigate the need and possible solutions for the conservation of our mineral resources.

12. The student will discover the important mineral resources in his locale by participating in a field trip.

13. The student will examine the various types of gem cutting equipment and their finished products.

COURSE OUTLINE

I. Minerals

A. Definition of minerals

1. Conditions necessary for a substance to qualify as a mineral

a. Inorganic
b. Natural formation
c. Solid
d. Definite internal atomic pattern
e. Specific chemical composition

2. Mineral families

a. Silicates
b. Carbonates
c. Oxides
d. Others

B. Identification of minerals

1. Visible characteristics

a. Color
b. Streak
c. Luster
d. Crystal form
e. Cleavage or fracture

2. Measuring for identification

a. Hardness tests
b. Specific gravity

3. Special properties

a. Magnetism
b. Electrical properties
c. Florescence
d. Phosphorescence
e. Radioactivity
f. Temperature of fusion
g. Optical properties

4. Testing methods

a. Chemical tests
b. Lab color tests

C. Classification of minerals

1. Metallic minerals

2. Nonmetallic minerals

3. Gem minerals

D. Minerals from the sea

II. Rocks

A. Definition

B. Classification

1. Igneous rocks

a. Origin
b. Formation

(1) Intrusive
(2) Extrusive

2. Sedimentary rocks

a. Formation
b. Types
c. Characteristics

3. Metamorphic rocks

a. Causes
b. Processes

(1) Thermal
(2) Dynamic

c. Characteristics

(1) Texture
(2) Composition

d. Classification

III. Rocks and Minerals in Our Lives

A. Soils

B. Fuels

C. Metals

1. Sources

2. Uses

D. Building stones

E. Glass and ceramics

F. Useful properties

1. Salt

2. Talc

3. Gypsum

4. Others

G. Conservation of mineral resources

IV. Rock and Mineral Collecting

A. Field trip

1. Equipment

2. Site Selection

3. Field notes

4. Precautions

5. Selecting specimens

B. Treatment of collected specimens

1. Identification

2. Classification

3. Labeling

4. Storing

V. Lapidary Art

A. Gem cutting

1. Types of gem stones

2. Preparation of stones

   a. Tumbling
   b. Cabachon
   c. Faceting

3. Equipment

B. Jewelry

C. Gems as a hobby

1. Sources of information

   a. Gem and mineral magazines
   b. Gem and mineral shows
   c. Gem and mineral clubs
   d. Gem and mineral shops

2. Utilization

EXPERIMENTS

Brandwein, Beck, Strahler, Brennan. The Earth: Its Changing Form.
New York: Harcourt, Brace & World, Inc., 1970.

1. Examining salt crystals (p. 41)
2. Making sulfur crystals (p. 41)
3. Growing alum crystals (p. 67)

Hibbs, Eiss. The Earth-Space Sciences.
Atlanta: Laidlaw Brothers, 1971.

4. Acid reaction on rocks (p. 429)
5. Effect of carbonic acid (p. 475, #3)

Bishop, Lewis, Bronough. Focus on Earth Science.
New York: Charles Merrill Publishing Co., 1969.

6. Process of crystalization (p. 70)
7. Formation of crystals in igneous rock (p. 97)
8. Disintegration of rock (p. 110)
9. Settlement of sediment (p. 113)
10. Formation of metamorphic rock (p. 128)

MacCracken, Decker, Read, Yarian. Earth Science.
New York: Singer Random House, 1964.

11. Heating limestone (p. 106)
12. How nodules form in ocean (p. 157)
13. Identifying common minerals (p. 160)
14. Difference between dolomite and limestone (p. 163)
15. Iron ore changed to iron (p. 164)

Navarra, Strahler. Our Planet in Space, the Earth Sciences.
New York: Harper & Row, 1967.

16. Oxidation of steel wool (p. 336)
17. Limestone and hydrochloric acid (p. 340)
18. Sulfur crystals (p. 450)
19. Volcanic glass (p. 452)
20. Examining salt grains (p. 453)
21. Specific gravity of igneous rock (p. 456)

Thurber, Kilburn. Exploring Earth Science.
Boston: Allyn Bacon, 1970.

22. Dehydrating gypsum (p. 26)

DEMONSTRATIONS

Brandwein, Beck, Strahler, Brennan. The Earth: Its Changing Form.
New York: Harcourt, Brace & World, Inc., 1970.

1. Cleavage and fracture (p. 41)
2. Reactions of steel wool (p. 55)
3. Effect of pressure (p. 58)
4. Chemical test for chalk (p. 60)
5. Effect of weight on sediment (p. 61)
6. Effect of freezing (p. 67, #1)

Brown, Kemper, Lewis. Earth Science.
Atlanta: Silver Burdett Co., 1970.

7. Sizes of sediment (p. 51)
8. Man made rock (p. 56)

Hibbs, Eiss. The Earth-Space Sciences.
Atlanta: Laidlaw Brothers, 1971.

9. Rapid crystal growth (p. 429, #1)

Thurber, Kilburn. Exploring Earth Science.
Boston: Allyn Bacon, 1970.

10. Models of 6 crystal systems (p. 42, #1)
11. Expansion of plaster of paris (p. 42, #4)
12. Measuring angle of cleavage (p. 42, #5)

PROJECTS

Bishop, Lewis, Bronough. Focus on Earth Science.
New York: Charles Merrill Publishing Co., 1969.

1. Identifying rocks (p. 134)
2. Notes on collecting rocks and minerals (p. 40)
3. Constructing mineral models (p. 67)
4. Drawing sides of crystals (p. 68)
5. Identifying minerals (p. 75)
6. Sorting igneous rocks (p. 102)
7. Sorting metamorphic rock (p. 134)
8. Testing metamorphic rock (p. 135)

Thurber, Kilburn. Exploring Earth Science.
Boston: Allyn Bacon, 1970.

9. Using a tumbler (p. 45, #3)
10. Mineral collection (p. 46, #5)
11. Jeweler (p. 46, #6)
12. Making sandpaper (p. 46, #7)
13. Gem cutter (p. 46, #10)
14. Exhibit of important minerals (p. 40, #11)
15. Portland cement plant (p. 40, #19)
16. Rock collection (p. 78, #1)
17. Economic importance of rocks (p. 79, #3)
18. Exhibit on how rocks are formed (p. 79, #5)

Hibbs, Eiss. The Earth-Space Sciences.
Atlanta: Laidlaw Brothers, 1971.

19. Chart of types of metamorphic rock and origin (p. 429, #3)
20. Building a tumbler (p. 472, #1)

TEACHER DIRECTED ACTIVITIES

Bishop, Lewis, Bronough. Focus on Earth Science.
New York: Charles Merrill Publishing Co., 1969.

1. Identifying minerals (p. 71)
2. Examining rock samples (p. 87)

Thurber, Kilburn. Exploring Earth Science.
Boston: Allyn Bacon, 1970.

3. Plaster of paris (p. 27)
4. Reducing galena (p. 28)
5. Reducing hematite (p. 28)
6. Dehydrating lime (p. 30)
7. Roasting pyrite (p. 31)
8. Geiger counter (p. 42)
9. Ultraviolet light (p. 44)
10. Flame tests (p. 44, #11)

Brandwein, Beck, Strahler, Brennan. The Earth: Its Changing Form.
New York: Harcourt Brace & World, Inc., 1970.

11. Examining pieces of granite (p. 57)
12. Examining sugar cube crystals (p. 57)
13. Growing crystals (p. 67, #3)
14. Sulfur crystals (p. 326)
15. Magnetic properties and specific gravity (p. 329, #2)

Hibbs, Eiss. The Earth-Space Sciences.
Atlanta: Laidlaw Brothers, 1971.

16. Discovering impurities in salt (p. 417)
17. Examining granite with hand lens (p. 417)

REPORTS

1. Minerals of economic importance

2. Rock and mineral resources of a locality or state (obtaining information from Chamber of Commerce bulletins, state publications, and journals)

3. Raw materials and processes used in the production of Portland cement

4. How mineral resources can be conserved

RELATED PROBLEMS

1. (Math) Calculate the approximate weight of a large rock, using its volume, specific gravity, and the density of water. Decide whether the shape of the rock is closest to that of a sphere, cylinder, cone, pyramid, or rectangular block. Select from a mathematics book the formula for determining the volume and make the necessary measurements. Chip off a sample of the rock and determine its specific gravity.

2. (Art) Plaster of paris can be used to make replicas of old art objects. Make a plaster cast of a shell.

3. (Math) The Cullinan diamond weighed 3,106 carats. There are 150 carats in an ounce or 2,400 carats in a pound. About how many pounds and ounces did the Cullinan diamond weigh?

4. (Math) Pure gold is 24 carat gold. You may buy a ring that is labeled 14-carat gold. What percentage of the ring is pure gold?

5. (Math) If the dry weight of a mineral specimen is 9.8 ounces and its weight in water is 5.7 ounces, what is its specific gravity?

ADDITIONAL INNOVATIVE ACTIVITIES

1. Obtain a bag of 100 assorted minerals from a prospector or shop. To sort them into piles of similar minerals, what would you do first? How might you sort each pile into smaller piles? Would you use color as one of the properties of the minerals to help you in sorting? Explain your reasoning.

2. Draw diagrams illustrating the cycles of changes in the formation of sedimentary, metamorphic, and igneous rocks. Remember that the cycles do not necessarily follow the same pattern every time.

3. Make glass as follows: Mix 1 teaspoonful of clean quartz sand, 1 teaspoon of sodium carbonate, and 1 teaspoon of lead dioxide in a metal can. Set the can in a hot fire outdoors or in a furnace for one hour. Then pour the contents of the can on several thicknesses of paper on the ground.

SUGGESTED DISCUSSION QUESTIONS

1. What is the probability that crystals are now forming in the earth's crust? Under what conditions would this process occur?

2. What determines whether a certain mineral is classified as a gem?

3. How would you explain the fact that rock formed deep in the earth can now be found near the earth's surface?

4. A sign frequently seen along newly built highways cut into the side of a mountain is "Caution! Falling Rocks." Why are such signs necessary even though the builder has removed all loose rock from the vicinity of the road cut?

5. Will there be any signs of weathering on the moon?

6. Are igneous rocks still forming? Metamorphic? Sedimentary rocks? Defend your answers.

7. Do you think the history of all rock formation can be determined easily? If not, what factors make the history of one rock formation easier to determine than that of another rock formation?

8. How would you explain why diamond and graphite are different minerals, although their chemical composition is identical?

9. Which of our natural resources are renewable? Which are non-renewable? Is there a chance that shortages of nonrenewable resources will run out in the near future?

10. If the entire crust of the earth is composed of the rocks and minerals from which many of our manufactured products are being made, why is there any need for concern about the conservation of mineral resources?

11. What minerals and ores can you think of that are important today that were not considered important 50 years ago?

12. How can we conserve the buried wealth in the crust so that mankind will not be faced with serious shortages in the future?

FIELD TRIPS

1. Museum of Science
   3280 South Miami Avenue, Miami Telephone: 854-4242
   A good collection of local rocks, mineral specimens, gem minerals, florescent minerals and two workrooms for gem cutting, one for faceting and the other for cabachon.
   (Miami Mineralogical and Gem Society meets at the Museum's auditorium the 4th Monday of every month. Guests are invited.)

2. Rock and Shell Shop
   2036 S. W. 57th Avenue, Miami Telephone: 666-3015
   Shop has a large selection of gem, mineral and lapidary supplies. Owner, Mr. Raether, is working in visual tapes on rock cutting and introduction to gems. He is willing to show them to small class groups.

3. Turkey Point Plant
   Florida Power and Light Co.
   Calcite crystals and fossils can be found along the canals which have been dug recently.
   For permission contact Mr. Tommie Thompson at Florida Power and Light, telephone 374-5333.

4. Maule Industries, Inc.
   Pensuco plant, 11000 N. W. 121st Street
   Contact Wayne Geschke, telephone 887-8993
   (Mr. Geschke could also give a talk on production.)
   Site of calcite and fossils

5. Lehigh Portland Cement Co.
   1200 N. W. 137th Avenue
   Contact Superintendent Ken Riveira, telephone 885-3911
   Site of calcite and fossils, also production

6. Seminole Rock Products Inc.
   8100 N. W. 74th Street
   Contact sales manager Pete Peacock, telephone 888-3496
   Site of calcite and fossils

7. Sterling Crush Stone
   Contact Hank Buss, telephone 235-4560
   Site of calcite and fossils

8. Calcite and fossils can be found in many areas of South Florida where digging is going on. Permission for rock hunting can be obtained from the Flood Control Department for canal sites. Mr. F. Park of the Dade County Water Control can also give areas of recent diggings.

SPEAKERS

1. Henry Kauffmann, hobbyist. Telephone: 667-3132
   An interesting speaker on mineralogy - special interest in ecology

2. Gladys Hakam, a hobbyist. Telephone: 891-6766
   She is willing to demonstrate gem cutting and talk on gem collecting. She has a wide variety of interesting rock specimens.

3. Aaron Spector, a hobbyist. Contact Museum of Science.
   Mr. Spector is considered the Miami area expert on mineral identification. Very interesting speaker and has much to display.

4. Bridget DeBonis, owner of Gem Art Studios. Telephone: 445-3741 or home phone, 223-6704.
   Mrs. DeBonis will prepare a locked display of gem minerals for class use. She is very knowledgeable in mineral and gem materials and all types of lapidary work.

5. Erwin Raether, owner of Rock and Shell Shop. Telephone: 666-8015
   Mr. Raether will speak and have a display in any area, such as minerals, gems or lapidary.

FILMS
Available from Dade County Audiovisual Center

				AV#
1.	Bromine: Element from the Sea			
	22', C	S	MLA	1-10804
2.	Carbon and Its Compounds			
	10'	S	Coronet	1-01968
3.	Crystal Gazing			
	15', C	JS	MIS	1-10949
4.	Crystals and Their Structure			
	22', BW	S	MLA	1-10824
5.	Crystals			
	25', BW	S	MLA	1-30342
6.	Minerals and Rocks			
	10', C	EJ	EBEC	1-10951
7.	Mining			
	20', BW	EJC	UW	1-11416
8.	Rocks and Gems			
	11', C	EJC	AV-ED	1-02160
9.	Rocks and Minerals			
	11', C	EJC	AV-ED	1-01976
10.	Rocks that Form the Earth's Surface			
	16', C	EJC	EBEC	1-11019
11.	Rocks that Originate Underground			
	23', C	EJS	EBEC	1-31387

12. Story in the Rocks
17½', C Shell Oil Company Films
149-07 Northern Boulevard
Flushing, New York
Free except for return postage

SLIDES

Available from Dade County Audiovisual Center

		AV#
1.	Crystals: Their Form and Color, Set 1 C EJS 2x2 slides in magazine, 28 slides	5-20015
2.	Crystals: Their Form and Color, Set 2 C EJS	5-20005
3.	Rock and Rock Formation (Part 1) C JS 2x2 slides in magazine, 22 slides	5-20011
4.	Rock and Rock Formation (Part 2) C JS	5-20056

FILMSTRIPS

5. Materials of the Earth's Crust
Ward's Natural Science Establishment, Inc.

Set of 6 color filmstrips totaling 379 frames
Separate filmstrip titles:

"The Minerals"
"Identification of Minerals"
"The Rocks"
"Igneous Rocks"
"Sedimentary Rocks"
"Metamorphic Rocks"

6. McGraw-Hill Text-Films Series
Set includes:

"How Rocks are Formed"
"What are Elements and Compounds?"
"What's in the Atom?"
"Wealth from Mother Earth"
"Atoms and Molecules"
"Atomic Structure and Chemistry"
"Minerals - How They Are Identified"
"Crystals"
"Structure of the Atom"

MODELS
Available from Dade County Audiovisual Center

1. Geology Models
   C8 EJS Denoyer-Geppert AV#6-00172
   Model: in wood case, 22½x19 - ½x14 - ½; SG

2. Igneous Rocks and Florida Minerals
   C26 EJS Museum Sci. AV#6-00120
   Model: 6 igneous rocks, 20 Florida minerals, in folding wooden case; SG

3. Rocks and Minerals
   C56 EJS Museum Sci. AV#6-00116
   Model: igneous, sedimentary, and metamorphic rocks in fibre case; guide in book form, plastic covered sheet

4. Sedimentary and Metamorphic Rocks
   C12 EJS Museum Sci. AV#6-00119
   Model: 7 items of sedimentary rocks; 5 items of metamorphic rock; SG; in wooden case

5. Phosphate Exhibit
   C162 EJS Florida Phosphate AV#6-00048

SOURCES FOR SUPPLIES

6. Geology equipment and rock and mineral specimens
   Ward's Establishment
   P. O. Box 1712, Rochester, New York

7. Rocks and minerals
   Eaton Scientific Corporation
   119 South Rosemead Boulevard, Pasadena, California

8. Mineral - sort, kits
   Filer's
   P. O. Box 372, Redlands, California

9. Rock and minerals
   Minerals Unlimited
   1724 University Avenue, Berkeley, California

10. Rocks and minerals
    U. S. Mineral Exploration Company
    1518 Gales Avenue
    Brooklyn 27, New York

REFERENCES

1. Berry, L. G. and Mason, Brian. Mineralogy: Concepts, Descriptions, Illustrations. San Francisco: W. H. Freeman and Co., 1959.

2. Bishop, Margaret; Lewis, Phyllis; and Bronough, Richard. Focus on Earth Science. New York: Charles Merrill Publishing Co., 1969.

3. Boy Scouts of America. Geology Merit Badge Pamphlet of Boy Scouts. Miami: South Florida Council.

4. Dana, J. D. and Hurlburt, C. S. Manual of Mineralogy. New York: John Wiley and Sons, 1952.

5. Dana, Edward S. and Hurlburt, C. S. Minerals and How to Study Them. New York: John Wiley and Sons, 1949.

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8. Holden, Alan and Singer, Phyllis. Crystals and Crystal Growing. New York: Doubleday & Co., Inc., 1960.

9. Loomis, Frederic B. Field Book of Common Rocks and Minerals. New York: Putnam Co., 1948.

10. MacCracken, Helen: Decker, Donald; Read, John; and Yarian, Alton. Earth Science. New York: Singer Random House, 1964.

11. MacLachlan, Don. Complete Book of Rocks, Gems, and Minerals. Los Angeles: Peterson Publishing Co., 1968.

12. Navarra, John and Strahler, Arthur. Our Planet in Space, The Earth Sciences. New York: Harper & Row, 1967.

13. Pearl, Richard M. Gems, Minerals, Crystals and Ores. (The Collector's Encyclopedia) New York: Odessey Press, 1964.

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15. Pearl, Richard M. Rocks and Minerals. New York: Barnes and Noble, Inc., 1956.

16. Pirssons, Louis B. Rocks and Rock Minerals. New York: John Wiley & Sons, 1947.

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18. Ramsey, Wm. L. and Burckley, Raymond. Modern Earth Science. New York: Holt, Rinehart & Winston, 1965.

19. Sinkankas, John. Gemstones of North America. Princeton, N.J.: Van Nostrand, Inc., 1962.

20. Sinkankas, John. Gem Cutting: A Lapidary's Manual. Princeton, N.J.: Van Nostrand, Inc., 1962.

21. Suchman, Richard J. and McCombs, L. Resource Book. Chicago: Science Research Associates, Inc., 1968.

22. Thurber, Walter and Kilburn, Robert. Exploring Earth Science. Boston: Allyn Bacon, 1970.

23. Zim, Herbert S. and Shaffer, Paul R. Rocks and Minerals. New York: Affiliated Publishers, 1957.

BEST COPY AVAILABLE

MASTER SHEET - BIBLIOGRAPHY

Objective	Texts	Experiments	Demonstrations	Projects	Teacher Directed Activities	Reports	Related Problems	Audio-Visual Interactive Activities	Computer Assisted Instruction	Field Trips	Specialists	Films	Slides and Film Strips	Models and Samples	References
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2	1. ch. 3 3. ch. 22								2		1,3	1 to 5	5,6		1 to 13, 18, 22, 23
3	1. ch. 3 2. Appendix 3. ch. 22	1,2,3,5,6,20,21,22	2,4,9,10,11,12	4	3,4,5,6,7,8,9,10,12,13,16		1		1		3	1 to 6,9	1,2,5,6	1,5,6-10	1-13, 18, 22, 23
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